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EDITORIAL COMMENT

Cardiovascular Imaging Utilization

Boom or Bust?*

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Because the growth in utilization of cardiovascular (CV) imaging since the 1990s has been so well documented and the findings so consistent, there is a general assumption that imaging is overused. Quality improvement efforts in imaging have become nearly synonymous with efforts to reduce use, whether they are appropriate use criteria (AUC), payer constraints on testing access, or the "Choose Wisely" campaign. Although imagers have countered with a call to emphasize value rather than volume, the message is still essentially the same: do less. These efforts have been successful with a "bending of the curve" of CV imaging growth beginning in 2008 (1). However, by limiting quality efforts to overuse, we ignore the very important possibility that underuse and misuse can also occur. Further, although overuse may result in a relatively harmless collection of redundant information, underuse may be associated with a failure to acquire critical information and diagnose and treat significant disease, arguably a more important concern. Worse, the efforts to reduce all imaging use could have the unintended consequence of reducing needed imaging, exacerbating the problem of underuse.

So, is there evidence of underuse in CV imaging? This is a difficult question to answer. AUC and guidelines generally do not address underuse, and there are few clinical scenarios in which a national standard calls for "must do" imaging. Further imaging occurs early in the process of symptom evaluation so that information about the number, characteristics, and outcomes of those who are not imaged is unavailable. Nevertheless, there are clues that imaging is, in fact, underutilized in some scenarios. Current AUC suggests that use of diagnostic catheterization and revascularization should be preceded by documentation of ischemia in most cases (2). In practice, Patel et al. (3) noted that 15% of nearly 300,000 elective diagnostic catheterizations in subjects without prior coronary artery disease did not have a preceding noninvasive test for ischemia, and Lin et al. (4) noted that only 44.5% of those undergoing elective angioplasty had a prior stress test. However, in both of these scenarios, there can be compelling reasons to proceed directly to an invasive procedure.

In contrast, the evaluation of systolic performance in patients with incident heart failure is a "must do" imaging indication, supported as 1 of just 5 performance measures for inpatients in the initial heart failure set from 2005 (the others are: use of angiotensin-converting enzyme inhibitors or angiotensin receptor blockers, anticoagulants in atrial fibrillation, smoking cessation, and discharge instructions) and 1 of 11 measures for outpatients (5). We previously used Medicare data to report limited adherence to this quality metric, with the prevalence of left ventricular function assessment increasing from 46% in 1995 to 60% in 2007 (6). At 79%, inpatients were nearly 4-fold more likely to be tested than outpatients in 2007. In this issue of *iJACC*, Farmer et al. (7) confirmed these data in a clinical trial population embedded in integrated delivery systems, and found a very similar prevalence of systolic function assessment of 73% during the same time period (2005 to 2008). Taken together, these 2 papers provide strong evidence in separate but large populations that CV imaging is indeed underutilized in roughly one-quarter of patients in an important and common clinical scenario. Quality efforts in imaging should recognize this gap; we can no longer focus exclusively on overuse and ignore underuse if we are truly striving to improve imaging care.

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The data from Farmer et al. (7) also confirm prior studies that found marked variability in imaging use among hospitals. Lin et al. (4) noted that prepercutaneous coronary intervention (PCI) stress testing rates ranged from 22.1% to 70.6% among the hospital referral regions; we have noted that 656 hospitals' use of stress testing in the first year after PCI

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ranged from 8.6% to 66.0% (8). Curtis et al. (6) did not compare testing rates by institution but did find 28% higher use of testing in the northeast as compared with the western United States. These findings confirm a quality gap. They also provide a natural experiment in which to examine outcomes. Does greater testing lead to better outcomes, as it should if there is underuse? The study by Farmer et al. (7) unfortunately did not provide outcomes and so it cannot address this issue; however, Curtis et al. (6) noted a 12% lower 1-year mortality rate among those who received a left ventricular function assessment compared with those who did not (hazard ratio: 0.88, 95% confidence interval: 0.86 to 0.91). Lin et al. (9) noted a 13% lower risk of death over 3.4 years in those who underwent pre-PCI stress (hazard ratio: 0.87; 95% confidence interval: 0.81 to 0.92). Although it is impossible to ascribe these differences to imaging per se, especially because its use is probably a marker for higher quality in other aspects of care, they do suggest that underuse of imaging can be dangerous to your patients' health.

There are several other important pieces of data presented that would be useful in designing quality improvement efforts. Farmer et al. (7) note that a failure to image was associated with advancing age, female sex, and other illnesses such as acute myocardial infarction and stroke. Curtis et al. (6) also found less imaging in older, sicker patients and women. These results are not surprising, as many authors have documented worse adherence to standards of care in these groups; however, they provide clues to which groups could be targeted in quality improvement efforts. Farmer et al. (7) also noted lower echocardiography use in patients with conditions that would normally be associated with a higher propensity to image, including atrial fibrillation and valvular heart disease; this raises the question of whether some testing use was not accurately captured. Indeed, the finding by Curtis et al. (6) that widening the window from 30 to 365 days increased testing prevalence by 8% for inpatients and 77% for outpatients suggests that a 14-day pre-admission window is too narrow to accurately detect the availability of information regarding systolic function, which is, of course, the goal rather than imaging use per se.

Other important data are still missing. Both of these reports are on the basis of claims data, and neither includes robust clinical information; the lack of a national imaging registry is a missed opportunity that would immeasurably help quality assessment efforts. For example, at present, the use of multiple tests can be documented (6,7), but their utility cannot be addressed without knowing testing indications or results. Similarly, the impact of ongoing changes in healthcare delivery, such as point-of-care decision support tools, accountable care organizations, and electronic medical records, which provide not only reports but actual images for review, cannot be assessed. Similarly, the potential impact of implementing imaging quality metrics using already established methodology is unknown, as none have yet been developed (10). Nevertheless, the time has come to address the entirety of imaging utilization if we are to improve imaging care.

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